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(54) **SYSTEM AND METHOD FOR COMMUNICATION MANAGEMENT WITH REDUNDANCY**

SYSTEM UND VERFAHREN FÜR KOMMUNIKATIONSVERWALTUNG MIT REDUNDANZ

SYSTEME ET PROCEDE DE GESTION A REDONDANCE DES COMMUNICATIONS

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Description

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention relates to a data storing first managed system comprising a number of Managed Objects (MO) representing resources or resource objects, which managed system is manageable by a managing system able to perform management operations on the managed system.

[0002] The invention also relates to a system comprising at least one managing system, a number of first managed systems and a number of second managed systems, each managed system comprising a number of Managed Objects (MO) representing resources, a management interface for providing communication between managing and managed systems via which management operations can be sent from the managing system(s) to the managed system(s).

[0003] Still further the invention relates to a method of providing redundancy in a system comprising at least a first and a second managed system, each of which comprises a number of managed objects.

STATE OF THE ART

[0004] The amount of information or data relating to a managed system can be high as well as complex to handle and sensitive etc. In these cases as well as in others it is often desirable to provide redundancy. Then it is important that the information or data in the redundant systems, which can be two or more, is the same and that when data in a system is changed by a managing system, it must be changed so that it remains consistent in the redundant managed systems.

[0005] In known systems replication of managed data of a managed system, e.g. a network element managed by TMN (Telecommunications Management Network) protocols can be carried out by replication of the actual changes of resource data from the network element that is addressed. Replicating on resource level is among others disadvantageous in that the further or secondary changes on a management level, in the MO such as consistency checks, logging, computer updates etc. are not replicated.

[0006] Replication can also be achieved through the managing system sending the same management operation to a number of redundant systems.

[0007] A serious drawback of implementing replication in this manner is that the management interface and the managing system, i.e. the operations system, themselves are affected which means that the operator and the Customer Administration System (CAS) must be aware of redundancy and therefore also be responsible for maintaining duplicated subscriber data etc.

[0008] In for example mobile communication systems of today real-time redundancy is often not applied but a number of systems are provided which merely provide for restoration in the case of a crash in for example a home location register. An example thereon is e.g. given in WO93/25051.

[0009] WO 94/23506 also relates to restoration of an HLR once a HLR crash has occurred in a first HLR unit and aims at improving the restoration procedure. However, none of these documents shows a system or a method capable of providing real-time redundancy, but are merely concerned with post-crash measures.

SUMMARY OF THE INVENTION

[0010] Therefore a system is needed which is robust and which provides a high degree of availability and reliability by means of providing redundancy. A system is needed through which management operations can be provided in at least a first and a second managed system in such a way that the data in the at least two managed systems always will be accurate and up-to-date.

[0011] A system is also needed through which, in case a first managed system fails for some reason, a redundant second managed system immediately can start executing without any loss of data. Still further a system is needed through which management operations can be invoked in at least two managed systems so that the data is kept consistent in both (or more) systems at all times and in that the up-dates or similar operations are transferred to at least two systems in a safe and consistent manner.

[0012] A system is also needed wherein redundancy does not affect the managing system itself as well as it does not affect the management interface between the managing and managed systems respectively.

[0013] A method is also needed through which redundancy is provided in a safe and reliable way so that data in redundant systems always is up-to-date and consistent within the systems.

[0014] A method is also needed through which redundancy can be provided without affecting a managing system which manages two or more managed systems and also without affecting the management interface between managing and managed systems.

[0015] To achieve these objectives there are provided a managed system according to claim 1, a system according to claim 16 and a method according to claim 18.

[0016] Therefore a data showing (first) managed system as initially referred to is provided which comprises means for implementing a replication function comprising a number of replication conditions, and, if a number of replication condition(s) is/are fulfilled, a management operation on one or more Managed Object (MO) instances is replicated by said replication function in the first managed system. It further comprises processing means for breaking down the management operation into a number of instance operations, and said means for implementing a replication function are arranged such that the management operation is replicated indirectly via replication of said instance operations, means being provided for

sending replicated said instance operations to a second managed system, thus providing redundancy.

[0017] A management operation may be a single operation in which case it merely addresses a single managed object instance or it may be a scope operation addressing a number of instances. Still further a filtering condition may be applied on the scope operation so that the management operation merely concerns some of the instances within the scope. This is in short called a filter operation.

[0018] In various embodiments one or more replication conditions may be given so that only instance operations fulfilling this or these conditions are replicated. The replication conditions may be of a number of different kinds. An example on a replication condition is that the instance operation has to be an up-dating operation. Generally, the management operations which can be performed on a managed object relate to the creation or deletion of an instance of a managed object, to the setting of an attribute value or the getting of an attribute value. A further operation relates to an action which requests a managed object to perform a task. All of these operations except for the getting of an attribute value relate to up-dating operations. The getting of an attribute value merely means reading and thus does not involve any change. Such an operation generally does not have to be replicated.

[0019] A number of conditions can be given in order that an operation be carried out in a first system for a start, such as an instance operation having to match instances comprised within the scope. Another condition relates to the instance operation having to match the instances comprised by the filter criteria. These are however not replication conditions but conditions for an operation to be carried out at all. This means that when scope and filter conditions have been evaluated, those instances are identified which should be subjected to the management operation in the first managed system or in the addressed system. In addition to e.g. scope and filter conditions, there can be further conditions such as e.g. relating to access conditions, security conditions etc. Replication conditions thus only refer to conditions which are or can be given to control which operations among those that are to be performed in a first managed system, also are to be performed in a second managed system.

[0020] However, a replication condition can be that an instance object of an instance operation in a first managed system must have an instance replica in a second managed system or in other words there must be corresponding instances in the two managed systems in order to make a replication of any use. Of course, as far as e.g. create operations are concerned there is no MO-instance in either of the managed systems, e.g. NEs. The replication is then taken to mean that there shall be a replica in the second managed system (as well as in the first). Such a replication condition thus has to state whether a managed object instance has or shall have, a redundant replica in the second managed system or not. This can for example be achieved by defining a replication container (or more if needed) by pointing out a sub-tree root in the management information tree (MIT) in which case operations towards sub-tree roots and all the instances contained within it are replicated. However, the replication conditions can be different in different applications and of course also other conditions, e.g. particularly implementation specific conditions may be given.

[0021] Generally replication conditions can be evaluated in an arbitrary order even if it is not always the case.

[0022] For explanatory reasons and in order to facilitate the understanding of the invention some concepts will be briefly discussed. The principles for a telecommunications management network are discussed in ITU-T (former CCITT) Recommendation M.3010. Systems management is also discussed in ITU-T Recommendation X.701. In a managed system the number of managed objects can be very high. In order to be able to keep track of all these managed objects they are kept in a tree structure which is denoted a Management Information Tree or a naming tree, c.f. ITU-T X. 720. The Management Information Tree MIT forms the management view of a managed system or particularly a network element and the relationships forming the naming tree are called containment relations. A containment relationship means that a managed object of one class may contain other managed objects of the same or other classes. It constitutes a relationship between managed object instances. This is e.g. more thoroughly described and a particular solution is given in a Swedish patent application 506 535, "Arrangement and method relating to information managing systems" filed June, 16 1995 by the same applicant. Said application among others relates to mapping managed objects to resources.

[0023] A managed object is only contained within one containing managed object and containing managed objects may themselves be contained in other managed objects. The containing relationship is used for naming managed objects and managed objects which are named in the terms of another object are denoted subordinate objects of the former whereas a managed object which establish the name in question for other objects is denoted a superior managed object of the latter. The highest level of the naming tree is denoted a root and it is as such an object without any associated properties.

[0024] All managed objects are given an instance name when they are created. All managed objects subordinated another managed object must have different instance names. Thus the instance name does not have to be unique within the naming tree but two or more managed objects can have the same instance name, the condition being that they are subordinated different managed objects. Every managed object also has a Distinguished Name DN. This name is unique within the naming tree and the naming starts from the root of the naming tree and ends with the instance name of the managed object.

[0025] A managed object may represent more than one resource or a combination of resources. A managed object may also represent other managed objects. Still

further two or more managed objects may represent different views of one and the same resource etc.

[0026] However, returning now to the redundancy issues, once it has been established that an instance operation is to be replicated, sometimes a translation has to be done for those parameters which have different values in the first and the second managed system respectively; for example the distinguished names can be different in a first and a second managed system. A mapping is then done between the instances of an addressed managed system and the redundant system and after translation, the instance operations are invoked in the first and second managed system respectively. The translation is according to a first embodiment carried out in the first managed system whereas according to an alternate embodiment it is done in the second managed system.

[0027] In particular embodiments of the present invention for scope or filter operations may apply so called atomic synchronization may be applied which means that an operation will only be performed if it can be successfully performed on every instance matching the scope and filter criteria that has been given. Alternatively best effort synchronization can be applied which means that an operation is performed on as many instances as possible.

[0028] In a particular embodiment of the invention relating to a Telecommunications Management Network the first and second managed systems comprise first and second network elements respectively and the managing system comprises an operations system. The management operations may particularly relate to operator updates relating for example to subscriber data etc. The first and second network elements even more particularly relate to a first and a second home location register of a mobile communication network. First and second respectively are merely denotations. Both the first and the second HLR (or managed system in general) act as a primary node for each one group of subscribers. In each HLR node there may be one or more primary subscriber groups and one or more secondary (back up) subscriber groups, i.e. a first HLR may act both as a primary HLR and as a stand-by or back-up HLR but for different groups. The same applies to the second HLR (one or more). Thus both a first and a second HLR (or managed system in general) have two functions.

[0029] A system as initially referred to is also given which, for providing redundancy, comprises means for performing a replication function for replicating a management operation, wherein a first managed system comprises processing means for, via processing in said first managed system breaking down the management operation into a number of managed object (MO) instance operations, said first managed system further comprising means for implementing a replication function for replicating each managed object (MO) instance operation, thus constituting the replication of the management operation. Further, means are provided for sending said managed object instance operations from said first managed system to at least one second managed system.

[0030] Moreover a method as initially referred to is provided which comprises the steps of, when a management operation is sent to a first managed system: establishing in the first managed system which managed object instances that are concerned; breaking down the management operation into a number of instance operations, and for each instance operation: examining if any replication conditions are given, and if so, examining if this/these are fulfilled; if yes, sending the instance operation to the at least one second managed systems; invoking the instance operation in the first and second managed system.

[0031] In an advantageous embodiment, if an operation failure occurs in any of the managed systems, the operations are revoked in both the first and the second managed system.

[0032] Particularly an operation may be revoked in case it cannot be successfully carried out in both the first and the second managed system(s) respectively.

[0033] It should however be clear that when reference is made to a second managed system, there may also be a number of second managed systems; the principle still remains the same.

BRIEF DESCRIPTION OF THE DRAWINGS

[0034] The invention will in the following be further described in a nonlimiting way under reference to the accompanying drawings in which:

FIG 1 schematically illustrates a single managed object instance operation,

FIG 2 is a schematical flow diagram relating to a scope and filter operation with replication, and

FIG 3 schematically illustrates a scope and filter operation with replication including distributed transactions.

DETAILED DESCRIPTION OF THE INVENTION

[0035] The invention will in the following particularly be described in relation to a telecommunications management network which for example may take the form of Telecommunications Management Network TMN as described in ITU-T (former CCITT) Recommendation M.3010. A particular embodiment of the invention relates to managed systems in the form of Network Elements NE. Even more particularly the invention will be described under reference to a particular embodiment relating to the provision of Home Location Register HLR redundancy in a mobile communication system. The invention is however by no means limited to home location registers of mobile communication systems but it relates to repli-

cation of management operations on managed systems in general. The invention for example relates to a way of replicating management operations or particularly operator updates which for example can be used to realize redundancy in the management interface of managed systems (of which network elements or even more particularly home location registers relate to particular embodiments), which e.g. store sensitive data or large amounts of data. The invention also relates to other replications wherein a safe access to management operations is needed such as for example relating to remote restoration logs and audits etc.

[0036] Generally subscriber data in a Home Location Register HLR can be updated in essentially two ways, namely by the network via the Mobile Application Part MAP and via the Operation and Maintenance operator via a Telecommunications Management Network TMN or TMN-like management operations. The present invention relates particularly to updates provided via TMN (or a similar network), i.e. not to updates via MAP and not to ordinary telephony traffic making updates.

[0037] Fig. 1 illustrates a managing system in the form of an Operations System OS managing a managed system, here particularly a, Network Element NE of a Telecommunications Management Network. The extent of a telecommunications management network is standardized in the abovementioned recommendation and it may comprise anything between a simple connection between an operations system and a network element and a whole network of operations systems controlling a large telecommunications network. An operator interface denoted Q3 has been standardized for a telecommunications system providing the connection between managing and managed systems, here operations system and network element.

[0038] The Q3 interface defines the object oriented information model of the network elements and the communication protocol between the Operations System OS and the Network Elements NE. Via the Q3 interface (e.g. relating to the GSM system the Q3 interface as standardized by TMN provides support for subscriber administration) an operator can do a number of operations on a Managed Object MO of a Network Element NE such as for example create a managed object, set a value in a managed object, get a value from a managed object, do an action on a managed object and delete a managed object. The Network Element NE can be said to be divided into a Management Layer ML comprising a number of Managed Objects MO which represent a number of resources or Resource Objects RO of a Resource Layer RL. The MO:s are all that is visible from the operations system and form the management view as is further explained below under reference to Fig. 1.

[0039] As already referred to earlier in the application the Managed Objects MO represent resources or Resource Objects RO which are the real implementation of the Network Element NE. A managed object may represent one or more resource objects or different managed objects may represent different views of one resource and a managed object may also represent a combination of resources. The resources or resource objects may comprise functional resources, logical resources or physical resources. A resource may e.g. be an internal resource in an MO or it may comprise an RO. Finally a managed object may represent other managed objects. The operation system OS can manipulate a management view of e.g. a traffic system represented by the resources by sending Q3 operations, i.e. management operations on the Q3 interface, from the manager to the agent. As referred to above MO instances can be arranged in a Management Information Tree MIT. A management operation may either address a single MO instance thus forming a single operation or a number of selected instances contained within a sub-tree of the MIT forming a scope operation. Such scope operations may furthermore be combined with one or more filter condition(s) in which case the operation will only be invoked on MO instances falling within the scope and matching the filter thus forming a scope and filter operation or shortly a filter operation. E.g. in known standards a scope can be defined in four different ways, namely: only the root object, the root object and all subordinate instances, the root object and all subordinated instances including line n and finally all instances on line n below the root object. In the present document the first scope is simply denoted a single operation whereas the other three are denoted scope operations or filter operations. This is merely a matter of denotation. However, this means that in a large network element NE or in for example a large HLR, a management operation may be directed to a large number of MO instances, which can be a quite time consuming operation.

[0040] Fig. 1 relates however to a single MO instance operation. A Managed Object MO_2 in the management layer ML represents a Resource Object RO_2 in the Resource Layer RL which forms the resource implementation of the Managed Object MO_2 and the storage of attribute values for MO_2. The resources are not visible to the operator or the Operations System OS but only the managed objects representing them, via the Management View MV as illustrated. From Fig. 1 can be seen the Managed Object MO_2 e.g. denoting a MO of a "subscriber 2". The managing system OS manipulates the management view of the traffic system (resources) by sending Q3 operations from the manager of the OS to the agent of the NE.

[0041] Scope and filter operations as referred to above can be synchronized in substantially two different ways, namely atomic synchronization and best effort synchronization. With atomic synchronization is meant that a management operation will either be successfully performed on all or none of the instances matching the scope and filter criteria whereas a best effort synchronization means that an operation will be performed on as many instances as possible. In other words, if a scope operation with atomic synchronization fails for one MO instance,

all changes will be undone and the complete operation will fail. If however best effort synchronization is applied, the operation will still be performed on the other instances irrespectively of whether it failed for one (or more) MO instance.

[0042] According to a particular embodiment a first and a second Home Location Register HLR_1 ,HLR_2 constitute the first and the second managed systems respectively. Of course there could also be more than one second managed system; second managed systems in the present document merely meaning that there is one or more than one system holding the corresponding data of another or a first system in any combination. There is also no inherent difference between a first and a second system. The denotation is merely used to indicate that there are more than one system, and that particularly one thereof is addressed.

[0043] Management operations towards a subscriber may be sent to either of the two Home Location Registers (in case there are two, if there are more than two, the operations can be sent to any of them) holding the corresponding data. Then the HLR receiving the management operation shall update the other one accordingly. Generally management operations towards a particular subscriber are directed to a particular HLR node. However, the invention is not affected by the addressing policy of any customer administration system.

[0044] Fig. 2 is a schematical flow diagram (giving one example on a flow) illustrating replication of a management operation sent from an Operations System OS relating to operator updates to a first Network Element NE, (which e.g. may be an HLR) over the Q3 interface. When the operation has been received in the addressed managed system, e.g. NE_1, a scope evaluation is carried out to establish which MO instances are concerned (or the maximum number of MO instances concerned). As referred to above, a management operation can be a single operation, a scope operation or a filter operation. When the scope has been established it is checked whether any filter criteria are to be fulfilled. This means that if a filtering is to be done, the filter is applied on each MO instance and the result thereof is a set of MO instances within the scope to which the operation has to be applied.

[0045] Moreover one or more replication conditions can be given which have to be fulfilled by the instance operations in order that they be replicated. It should be noted that there does not have to be any replication conditions, but that there may be one or more. Moreover is the internal order of independent replication conditions not important. They can often be evaluated in any order. One example on a replication condition is that the operation is an updating operation. This means that the operation as such must change data; if data is not changed, there is no need for a replication. As discussed earlier in the application the operations create, set, delete and action are operations which may change data. If the operation is not an updating operation, data can be read etc, this being irrelevant for the present invention. Generally the operation is then only invoked locally in NE_1.

[0046] If however the operation is of an updating nature, it is proceeded to a second replication condition (as already discussed above the order is not relevant but they are just denoted first, second etc. for exemplifying reasons) stating that an MO instance has to be redundant. This means that it is examined whether the MO instance as such is or shall be present in both NE_1 and NE_2. If there is no, or shall not be such an MO instance in the second managed system NE_2, it is incorrect to replicate that instance operation. The replication condition relating to whether an MO instance has a redundant replica in a second Network Element NE_2 can take a number of different forms, for example depending on the implementation concerned etc. One example thereon may relate to a replication container which is defined by pointing out a sub-tree root in the MIT. Then operations towards the sub-tree root and all the instances contained within it, are to be replicated.

[0047] If the given replication conditions are fulfilled (the replication conditions discussed above merely constitute examples, a number of alternatives are possible and there can be fewer as well as more), the instance operation is sent to NE_2. Before that however, if there are any node specific parameters in the operation, these have to be translated into the corresponding values for NE_2. This is the case for attributes in operations of type distinguished name since the MO instances in the first and the second NE respectively have different distinguished names.

[0048] Alternatively the translation can be carried out in the second managed system after replication of the operation, but before invoking it in NE_2. After translations are done, the corresponding instance operation is invoked in the second managed system, here NE_2. If the operation is successful both in NE_1, NE_2, this can be reported to the operations system if the operator so requests. The sending of confirmation reports can also depend on the kind of operation etc. For example, according to ITU-T X.710 success confirmation and failure confirmation is applied for create, delete, get, set and action operating only if the operator so requiests. If however the operation fails in any of NE_1, NE_2, it is rolled back or undone in some way and the Operations System OS is informed thereon, e. g. via an error message if failure confirmation is applicable.

[0049] In order to make sure that the content in NE_1 is consistent with the content in NE_2, the operations in the two NEs may be included in a distributed transaction. The data will then be updated consistently in both systems. This is particularly important if the management operation is a so called atomic scope operation wherein the transactions may include thousands of MO instances.

[0050] If the management operation is a single operation or a best effort scope operation, there will be several distributed transactions, one for each instance operation. If on the other hand the management operation is an atomic scope operation there will only be one distributed

transaction which includes all instance operations.

[0051] According to a first embodiment the instance operations are done consecutively one by one. This means that for an instance operation on an MO meeting e.g. scope and filter requirements the replication conditions are examined (in any desired order), translations (if any) and replication is done and the operation is invoked in both (in case there are two) NE:s. Only after invoking the operation is proceeded to the next instance operation. In an alternative embodiment a number of instance operations are invoked parallelly, i.e. the whole procedure is done in parallell. If the execution is done in sequence or in parallell or partly parallell etc. depends e.g. on the particular implementation.

[0052] Fig. 3 more clearly illustrates a scope and filter operation with replication wherein the invocation of the operations is included in coordinated transactions.

[0053] In Fig. 3 a scope and filter management operation with best effort synchronization is sent to a first managed system, which in this embodiment is a Home Location Register HLR_1.

[0054] "1" indicates the reception of the management operation in the addressed HLR_1. A scope evaluation 2 is then carried out as also discussed under reference to Fig. 2. The scope evaluation results in a set of MO instances, i.e. a stream of objects MO(2) to which the filter is to be applied through a filter evaluation 3. The filter is applied on each MO instance and the result thereof is a set of MO instances or a stream of objects MO(3) to which the operation is to be applied, i.e. a set of selected managed objects 4 is formed.

[0055] The instance operations are then transmitted (e.g. one by one) to the replication function 5 which comprises a number of replication conditions as also discussed earlier. According to the first (here) replication condition 6 is checked whether the operation is an updating operation, i.e. if it relates to creation of, deletion of, setting a value in or doing an action on a managed object. If the operation is not an updating operation, no replication is carried out and the operation may then only be invoked locally. If on the other hand it is established that it is an updating operation, then the second replication condition 7 is evaluated for each selected MO instance to see if it is a redundant MO instance, i.e. if the MO instance shall be replicated. This is done for example by pointing out a sub-tree in the MIT 7a.

[0056] If it is not a redundant MO instance, no replication takes place and the operation is only invoked locally. For each redundant MO instance however, a translation is done and the corresponding instance operation is sent to the second HLR, HLR_2. As referred to earlier, the translation can in principle be done either in the first or in the second HLR, if only it is done before invoking the operation in the second HLR. It should however be noted that only node-specific parameters of the operation have to be translated as discussed above under reference to Fig. 2. The translation operation may e.g. be carried out via replica-mapping 8a between two MIT:s.

[0057] In HLR_2 the operation is invoked within a transaction on the MO replica-B. The instance operation 9 is also invoked within a transaction on the local MO replica-A in HLR_1. Via the transaction coordinator 10 the transactions are so coordinated that the operation either succeeds in both or none of the first and second HLR_1 and HLR_2 respectively. The alternatives of synchronization of scope or filter operations have already been discussed. If it is a scope operation with best effort synchronization, the transactions will be coordinated per replicated MO pair (one in HLR_1 and one in HLR_2). If the operation is a scope operation with atomic synchronization the coordinated transaction will include all instance operations.

[0058] Finally, if the operation succeeds both in HLR_1 and HLR_2 a confirmation that the operation has been successful may be sent to the operator or to the operations system even if this is not the case for all operations. For some operations the operator can choose if he wants a confirmation or not. If however the operation has failed either in HLR_1 or in HLR_2 (or both), a message that the operation has failed is in some cases sent to the operator as the result 11 (for a number of operations (as discussed earlier) only if the operator so requests).

[0059] Although the invention has been particularly described under reference to managed systems in the form of home location registers in a mobile communication system, the invention is by no means limited thereto but applies to any kind of managed system wherein management operations are carried out by an operator or an operations system or generally it is applicabale to any application wherein access to management operations is needed such as for example remote logs and audits etc.

[0060] It is an advantage of the invention that the operator or an operation system does not have to be aware about redundancy or in other words redundancy is hidden for the operator or operations systems. Moreover standardized management interfaces are not affected by the replication.

[0061] Another advantage of the invention is that scope synchronization is preserved. Moreover, apart from handling attribute values, use is made of additional MO functionality such as for example consistency checks. It is to be noted that in case the MO functionality results in external event reports or invokation of signalling (MAP) services, the information model might require that such events are suppressed in some of the NEs in order to prevent multiple or incorrect external events. Still other advantages are that 2 and 3 phase commit transaction protocols are rendered possible and interference with MAP (Mobile Application Part) traffic as well as other management operations adressing either one of the redundant nodes is prevented by synchronous locking of MO instances. The latter relates to the particular embodiment as described relating to a mobile communication system. However, the invention can be varied freely, being merely limited by the scope of the claims.

Claims

1. A data storing first managed system (NE_1;HLR_1) comprising a number of Managed Objects (MO) representing resources or resource objects, which managed system is manageable by a managing system able to perform management operations on the managed system,
characterized in,
that it comprises means for implementing a replication function (5) comprising a number of replication conditions such that if a number of replication condition (s) is/are fulfilled, a management operation on one or more Managed Object (MO) instances is replicated by said replication function (5) in the first managed system (NE_1), that it comprises processing means for breaking down the management operation into a number of instance operations, and in that said means for implementing a replication function (5) are arranged such that the management operation, is replicated indirectly via replication of said instance operations, and in that means are provided for sending said replicated instance operations to a second managed system (NE_2, HLR_2), thus providing redundancy.

2. A system according to claim 1,
characterized in,
that the management operation is a single operation, i.e. it merely addresses a single Managed Object (MO) instance.

3. A system according to claim 1,
characterized in,
that the management operation is a scope operation addressing a number of Managed Object (MO) instances.

4. A system according to claim 3,
characterized in,
that the management operation comprises at least one filtering condition which is applied on the scope operation, the management operation thus forming a filter operation.

5. A system according to any one of claims 1-4,
characterized in,
that the replication function (5) comprises one or more replication conditions and is such that only instance operations fulfilling said replication condition(s) are replicated.

6. A system according to claim 5,
characterized in,
that a first replication condition states that the instance operation has to be an updating operation.

7. A system according to claim 6,
characterized in,
that the instance operation relates to one or more of the operations creating a managed object (MO), deleting a managed object (MO), setting a value in a managed object (MO) and invoking an action on a managed object (MO) instance.

8. A system according to claims 4 and 6,
characterized in,
that the means for implementing the replication function (5) are arranged such that the replication conditions are only used on the instance operations matching instances comprised within the scope of the scope operation.

9. A system according to anyone of claims 5-8,
characterized in,
that the replication function (5) comprises a replication condition which states that an object instance of an instance operation in a first managed system (NE_1;HLR_1) shall have an instance replica in a second managed system (NE_2,HLR_2).

10. A system according to claim 9,
characterized in,
that the means for implementing the replication function (5) are arranged such that at least one replication container is defined by pointing out a sub-tree root in a management information tree (MIT) containing the Managed Object (MO) instances and that for instance operations towards sub-tree roots and/or all instances contained within a replication is carried out unless there is/are other replication condition(s) which is/are not fulfilled.

11. A system according to any one of the preceding claims,
characterized in,
that means (8a) for implementing a translation functionality are provided in the first managed system (NE_1) arranged such that for replicated instance operations, a translation is done of those parameters having different values in the first and the second managed systems respectively.

12. A system according to claim 3 and any one of claims 4-11,
characterized in,
that it comprises a transaction coordinator (10) for coordinating transactions, and in that the scope or filter operation is adapted to apply atomic synchronization, i.e. the transaction coordinator (10) is adapted to coordinate transactions such that an operation will only be performed if it can be successfully performed on every instance matching the scope of the scope operation and, if any, filter conditions, and all their replicas.

13. A system according to anyone of claims 3-11, **characterized in, that** it comprises a transaction coordinator (10) and in that the scope operation is adapted to apply best effort synchronization, i.e. the transaction coordinator (10) is adapted to coordinate the operation such that it is performed on all replicas of as many instances as possible.

14. A system according to any one of the preceding claims, **characterized in, that** the first managed system comprises a first network element (NE_1) .

15. A system according to claim 14, **characterized in, that** the first network element comprises a first Home Location Register (HLR_1).

16. A system comprising at least one managing system (OS), a number of first managed systems (NE_1;HLR_1) and a number of second managed systems (NE_2;HLR_2), each managed system (NE_1, NE_2; HLR_1, HLR_2) comprising a number of Managed Objects (MO) representing resources, a management interface (Q3) for providing communication between managing and managed systems via which management operations can be sent from the managing system(s) (OS) to the managed system(s) (NE_1,NE_2;HLR_1,HLR_2), **characterized in, that** for providing redundancy, means for implementing a replication function are provided for replicating a management operation, that a first managed system comprises processing means for, via processing in said first managed system (NE_1;HLR_1) breaking down the management operation into a number of managed object (MO) instance operations, said first managed system further comprising means for implementing a replication function (5) for replicating each managed object (MO) instance operation, thus constituting the replication of the management operation and in that means are provided for sending said managed object instance operations from said first managed system to at least one second managed system (NE_2; HLR_2) .

17. A system according to claim 16, **characterized in that** means (8a) for implementing a translation functionality are provided in the first and/or second managed system arranged such that for replicated instance operations, a translation is done of those parameters having different values in the first and the second managed systems respectively.

18. A method of providing redundancy in a system comprising at least a first and a second managed system, each of which comprises a number of managed objects (MO), the method comprising the steps of: when a management operation is sent to a first managed system (NE_1;HLR_1):

- establishing in the first managed system (NE_1;HLR_1) which managed object instances are concerned,
- breaking down the management operation into a number of instance operations, and

for each instance operation:

- examining if any replication conditions are given, and if so, examining if this/these are fulfilled,
- if yes, sending the instance operation to the at least one second managed systems,
- invoking the instance operation in the first and second managed system.

19. Method according to claim 18, **characterized in, that** it comprises the further steps of:

- translating the parameters of an instance operation that have different values in the first and second systems respectively.

20. Method according to claim 19, **characterized in, that** the translation is done in the first managed system before sending the instance operation to the at least one second managed systems.

21. Method according to claim 19, **characterized in, that** it comprises the steps of:

- sending a replicated instance operation to a second managed system,
- making the translation in the second managed system,
- invoking the instance operation.

22. Method according to any one of claims 18-21, **characterized in, that** the instance operations of a management operation are replicated and invoked one by one.

23. Method according to any one of claims 18-21, **characterized in, that** a number of instance operations of a management operation at least in part are handled parallelly.

24. A method according to anyone of claims 18-23, **characterized in, that** if an operation failure occurs in any of the man-

aged systems, the operations are revoked in both the first and second managed system.

Patentansprüche

1. Datenspeicherndes erstes verwaltetes System (NE_1; HLR_1), das eine Anzahl von Managed Objects (MO, verwaltete Objekte) umfasst, die Ressourcen oder Ressourcenobjekte darstellen, wobei das verwaltete System von einem verwaltenden System verwaltbar ist, das an dem verwalteten System Verwaltungsoperationen durchführen kann, **dadurch gekennzeichnet, dass** es Mittel zum Implementieren einer Replikationsfunktion (5) umfasst, die eine Anzahl von Replikationsbedingungen umfasst, so dass, wenn eine bzw. eine Anzahl von Replikationsbedingungen erfüllt ist, eine Verwaltungsoperation an einer oder mehreren Managed-Object-Instanzen (MO-Instanzen) von der Replikationsfunktion (5) in dem ersten verwalteten System (NE_1) repliziert wird, dass es Verarbeitungsmittel zum Aufschlüsseln der Verwaltungsoperation in eine Anzahl von Instanzoperationen umfasst und dass die Mittel zum Implementieren einer Replikationsfunktion (5) derart eingerichtet sind, dass die Verwaltungsoperation mittels Replikation der Instanzoperationen indirekt repliziert wird, und dass Mittel zum Senden der replizierten Instanzoperationen an ein zweites verwaltetes System (NE_2, HLR_2) bereitgestellt sind, wodurch Redundanz bereitgestellt wird.

2. System nach Anspruch 1, **dadurch gekennzeichnet, dass** es sich bei der Verwaltungsoperation um eine Einzeloperation handelt, d. h. sie adressiert lediglich eine einzige Managed-Object-Instanz (MO-Instanz).

3. System nach Anspruch 1, **dadurch gekennzeichnet, dass** es sich bei der Verwaltungsoperation um eine Bereichsoperation handelt, die eine Anzahl von Managed-Object-Instanzen (MO-Instanzen) adressiert.

4. System nach Anspruch 3, **dadurch gekennzeichnet, dass** die Verwaltungsoperation mindestens eine Filterbedingung umfasst, die auf die Bereichsoperation angewendet wird, wodurch die Verwaltungsoperation eine Filteroperation bildet.

5. System nach einem der Ansprüche 1 - 4, **dadurch gekennzeichnet, dass** die Replikationsfunktion (5) eine oder mehrere Replikationsbedingungen umfasst und derart ist, dass nur Instanzoperationen, die die Replikationsbedingung bzw. Replikationsbedingungen erfüllen, repliziert werden.

6. System nach Anspruch 5, **dadurch gekennzeichnet, dass** eine erste Replikationsbedingung festlegt, dass die Instanzoperation eine Aktualisierungsoperation sein muss.

7. System nach Anspruch 6, **dadurch gekennzeichnet, dass** die Instanzoperation mit einer oder mehreren der Operationen Erstellen eines Managed Object (MO), Löschen eines Managed Object (MO), Einstellen eines Werts in einem Managed Object (MO) und Aufrufen einer Aktion an einer Managed-Object-Instanz (MO-Instanz) zusammenhängt.

8. System nach den Ansprüchen 4 und 6, **dadurch gekennzeichnet, dass** die Mittel zum Implementieren der Replikationsfunktion (5) derart eingerichtet sind, dass die Replikationsbedingungen nur an den Instanzoperationen verwendet werden, die mit Instanzen übereinstimmen, die vom Bereich der Bereichsoperation umfasst sind.

9. System nach einem der Ansprüche 5 - 8, **dadurch gekennzeichnet, dass** die Replikationsfunktion (5) eine Replikationsbedingung umfasst, die festlegt, dass eine Objektinstanz einer Instanzoperation in einem ersten verwalteten System (NE_1; HLR_1) eine Instanzreplik in einem zweiten verwalteten System (NE_2, HLR_2) haben soll.

10. System nach Anspruch 9, **dadurch gekennzeichnet, dass** die Mittel zum Implementieren der Replikationsfunktion (5) derart eingerichtet sind, dass mindestens ein Replikationscontainer definiert wird, indem auf eine Unterbaumwurzel in einem Management-Informationsbaum (Management Information Tree, MIT) hingewiesen wird, die die Managed-Object-Instanzen (MO-Instanzen) enthält, und dass für Instanzoperationen zu Unterbaumwurzeln und/oder alle Instanzen, die darin enthalten sind, eine Replikation durchgeführt wird, außer wenn eine andere Replikationsbedingung bzw. andere Replikationsbedingungen vorliegt bzw. vorliegen, die nicht erfüllt ist bzw. sind.

11. System nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** in dem ersten verwalteten System (NE_1) Mittel (8a) zum Implementieren einer Übersetzungsfunktionalität bereitgestellt sind, die derart eingerichtet sind, dass für replizierte Instanzoperationen eine Übersetzung derjenigen Parameter vorgenommen wird, die in dem ersten und dem zweiten verwalteten System unterschiedliche Werte aufweisen.

12. System nach Anspruch 3 und einem der Ansprüche 4 - 11, **dadurch gekennzeichnet, dass** es einen Transaktionskoordinator (10) zum Koordinieren von Transaktionen umfasst und dass die Bereichs- oder Filteroperation zum Anwenden von atomarer Syn-

chronisation eingerichtet ist, d. h. der Transaktionskoordinator (10) ist zum Koordinieren von Transaktionen eingerichtet, so dass eine Operation nur durchgeführt wird, wenn sie an jeder Instanz, die mit dem Bereich der Bereichsoperation und, falls vorhanden, Filterbedingungen übereinstimmt, und all ihren Repliken erfolgreich durchgeführt werden kann.

13. System nach einem der Ansprüche 3 - 11, **dadurch gekennzeichnet, dass** es einen Transaktionskoordinator (10) umfasst und dass die Bereichsoperation zum Anwenden von Best-Effort-Synchronisation eingerichtet ist, d. h. der Transaktionskoordinator (10) ist zum Koordinieren der Operation eingerichtet, so dass sie an allen Repliken von so vielen Instanzen wie möglich durchgeführt wird.

14. System nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** das erste verwaltete System ein erstes Netzelement (NE_1) umfasst.

15. System nach Anspruch 14, **dadurch gekennzeichnet, dass** das erste Netzelement eine erste Heimdatei (Home Location Register, HLR_1) umfasst.

16. System, umfassend mindestens ein verwaltendes System (OS), eine Anzahl von ersten verwalteten Systemen (NE_1; HLR_1) und eine Anzahl von zweiten verwalteten Systemen (NE_2; HLR_2), wobei jedes verwaltete System (NE_1, NE_2; HLR_1, HLR_2) eine Anzahl von Managed Objects (MO) umfasst, die Ressourcen darstellen, eine Managementschnittstelle (Q3) zum Bereitstellen von Kommunikation zwischen verwaltenden und verwalteten Systemen, über die Verwaltungsoperationen von dem verwaltenden System bzw. den verwaltenden Systemen (OS) an das verwaltete System bzw. die verwalteten Systeme (NE_1, NE_2; HLR_1, HLR_2) gesendet werden können, **dadurch gekennzeichnet, dass** zum Bereitstellen von Redundanz Mittel zum Implementieren einer Replikationsfunktion zum Replizieren einer Verwaltungsoperation bereitgestellt sind, dass ein erstes verwaltetes System Verarbeitungsmittel zum Aufschlüsseln der Verwaltungsoperation in eine Anzahl von Managed-Object-Instanzoperationen (MO-Instanzoperationen) mittels Verarbeitung in dem ersten verwalteten System (NE_1; HLR_1) umfasst, wobei das erste verwaltete System weiterhin Mittel zum Implementieren einer Replikationsfunktion (5) zum Replizieren jeder Managed-Object-Instanzoperation (MO-Instanzoperation) umfasst, wodurch die Replikation der Verwaltungsoperation gebildet wird, und dass Mittel zum Senden der Managed-Object-Instanzoperationen von dem ersten verwalteten System zu mindestens einem zweiten verwalteten System (NE_2; HLR_2) bereitgestellt sind.

17. System nach Anspruch 16, **dadurch gekennzeichnet, dass** in dem ersten und/oder dem zweiten verwalteten System Mittel (8a) zum Implementieren einer Übersetzungsfunktionalität bereitgestellt sind, die derart eingerichtet sind, dass für replizierte Instanzoperationen eine Übersetzung derjenigen Parameter vorgenommen wird, die in dem ersten bzw. dem zweiten verwalteten System unterschiedliche Werte aufweisen.

18. Verfahren zum Bereitstellen von Redundanz in einem System, das mindestens ein erstes und ein zweites verwaltetes System umfasst, die jeweils eine Anzahl von Managed Objects (MO) umfassen, wobei das Verfahren die folgenden Schritte umfasst: wenn eine Verwaltungsoperation an ein erstes verwaltetes System (NE_1; HLR_1) gesendet wird:

- Feststellen in dem ersten verwalteten System (NE_1; HLR_1), welche Managed-Object-Instanzen betroffen sind,
- Aufschlüsseln der Verwaltungsoperation in eine Anzahl von Instanzoperationen und

für jede Instanzoperation:

- Prüfen, ob etwaige Replikationsbedingungen festgelegt sind, und, falls das der Fall ist, Prüfen, ob diese erfüllt ist bzw. sind,
- falls Ja, Senden der Instanzoperation an das mindestens eine zweite verwaltete System,
- Aufrufen der Instanzoperation in dem ersten und dem zweiten verwalteten System.

19. Verfahren nach Anspruch 18, **dadurch gekennzeichnet, dass** es die folgenden weiteren Schritte umfasst:

- Übersetzen der Parameter einer Instanzoperation, die in dem ersten bzw. dem zweiten System unterschiedliche Werte aufweisen.

20. Verfahren nach Anspruch 19, **dadurch gekennzeichnet, dass** die Übersetzung in dem ersten verwalteten System vorgenommen wird, bevor die Instanzoperation an das mindestens eine zweite verwaltete System gesendet wird.

21. Verfahren nach Anspruch 19, **dadurch gekennzeichnet, dass** es die folgenden Schritte umfasst:

- Senden einer replizierten Instanzoperation an ein zweites verwaltetes System,
- Durchführen der Übersetzung in dem zweiten verwalteten System,
- Aufrufen der Instanzoperation.

22. Verfahren nach einem der Ansprüche 18 - 21, **da-**

durch gekennzeichnet, dass die Instanzoperationen einer Verwaltungsoperation eine nach der anderen repliziert und aufgerufen werden.

23. Verfahren nach einem der Ansprüche 18 - 21, **dadurch gekennzeichnet, dass** eine Anzahl von Instanzoperationen einer Verwaltungsoperation zumindest teilweise parallel bearbeitet werden.

24. Verfahren nach einem der Ansprüche 18 - 23, **dadurch gekennzeichnet, dass**, wenn ein Fehlschlag einer Operation in einem beliebigen der verwalteten Systeme eintritt, die Operationen in sowohl dem ersten als auch dem zweiten verwalteten System widerrufen werden.

Revendications

1. Premier système géré de mémorisation de données (NE_1; HLR_1) comprenant un certain nombre d'objets gérés (Managed Object MO) représentant des ressources ou des objets de ressource, lequel système géré est gérable par un système de gestion susceptible de réaliser des opérations de gestion sur le système géré,
caractérisé en ce que,
il comprend des moyens pour mettre en oeuvre une fonction de reproduction (5) comprenant un certain nombre de conditions de reproduction, telles que si une ou un certain nombre de conditions de reproduction sont remplies, une opération de gestion sur une ou plusieurs instances d'objets gérés (MO) est reproduite par ladite fonction de reproduction (5) dans le premier système géré (NE_1), **en ce qu'**il comprend des moyens de traitement pour décomposer l'opération de gestion en un certain nombre d'opérations d'instances, et **en ce que** lesdits moyens pour mettre en oeuvre une fonction de reproduction (5) sont configurés de telle façon que l'opération de gestion est reproduite indirectement par l'intermédiaire desdites opérations d'instances, et **en ce que** des moyens sont prévus pour envoyer lesdites opérations d'instances reproduites à un deuxième système géré (NE_2, HLR_2), offrant ainsi une redondance.

2. Système selon la revendication 1,
caractérisé en ce que,
l'opération de gestion est une opération unique, à savoir, il s'adresse simplement à une seule instance d'objet géré (MO).

3. Système selon la revendication 1,
caractérisé en ce que,
l'opération de gestion est une opération de portée s'adressant à un certain nombre d'instances d'objets gérés (MO).

4. Système selon la revendication 3,
caractérisé en ce que,
l'opération de gestion comprend au moins une condition de filtrage qui est appliquée à l'opération de portée, l'opération de gestion formant ainsi une opération filtre.

5. Système selon l'une quelconque des revendications 1 à 4,
caractérisé en ce que,
la fonction de reproduction (5) comprend une ou plusieurs conditions de reproduction et est telle que seulement les opérations d'instances remplissant ladite ou lesdites conditions de reproduction sont reproduites.

6. Système selon la revendication 5,
caractérisé en ce que,
une première condition de reproduction énonce que l'opération d'instance doit être une opération d'actualisation.

7. Système selon la revendication 6,
caractérisé en ce que,
l'opération d'instance a trait à une ou plusieurs des opérations créant un objet géré (MO), effaçant un objet géré (MO), définissant une valeur dans un objet géré (MO) et invoquant une action sur une instance d'objet géré (MO).

8. Système selon les revendications 4 et 6,
caractérisé en ce que,
les moyens pour mettre en oeuvre la fonction de reproduction (5) sont configurés de telle sorte à n'employer que les conditions de reproduction sur les opérations d'instances qui correspondent aux instances comprises dans la portée de l'opération de portée.

9. Système selon l'une quelconque des revendications 5 à 8,
caractérisé en ce que,
la fonction de reproduction (5) comprend une condition de reproduction qui énonce qu'une instance d'objet d'une opération d'instance dans un premier système géré (NE_1, HLR_1) aura une reproduction d'instance dans un deuxième système géré (NE_2, HLR_2).

10. Système selon la revendication 9,
caractérisé en ce que,
les moyens pour mettre en oeuvre la fonction de reproduction (5) sont configurés de sorte qu'au moins un conteneur de reproduction est défini en désignant une racine de sous-arbre dans un arbre d'information de gestion (MIT) contenant les instances d'objets gérés (MO) et que, pour les opérations d'instances vers les racines de sous-arbres et/ou toutes les

instances qui y sont contenues, une reproduction est effectuée à moins qu'il n'y ait une autre ou d'autres conditions de reproduction qui ne sont pas remplies.

11. Système selon l'une quelconque des revendications précédentes,
caractérisé en ce que,
des moyens (8a) pour mettre en oeuvre une fonctionnalité de translation, sont prévus dans le premier système géré (NE_1), configurés de telle sorte que pour des opérations d'instances reproduites, une translation est effectuée sur les paramètres ayant respectivement des valeurs différentes dans les premier et deuxième systèmes gérés.

12. Système selon la revendication 3, et selon l'une quelconque des revendications 4 à 11,
caractérisé en ce que,
il comprend un coordinateur (10) de transactions pour coordonner les transactions, et **en ce que** l'opération de portée ou de filtre est adaptée en vue d'adapter une synchronisation atomique, à savoir, le coordinateur (10) de transactions est adapté aux transactions coordonnées de sorte qu'une opération ne sera exécutée que si elle peut être exécutée avec succès sur chaque instance correspondant à la portée de l'opération de portée et, aux conditions de filtre s'il y en a, et à toutes leurs reproductions.

13. Système l'une quelconque des revendications 3 à 11,
caractérisé en ce que,
il comprend un coordinateur de transactions (10) et **en ce que** l'opération de portée est adaptée en vue d'appliquer la synchronisation sur la base du meilleur effort, à savoir le coordinateur de transactions (10) est adapté en vue de coordonner l'opération de sorte à l'exécuter sur toutes les reproductions d'autant d'instances que possible.

14. Système selon l'une quelconque des revendications précédentes,
caractérisé en ce que,
le premier système géré comprend un premier élément de réseau (NE_1).

15. Système selon la revendication 14,
caractérisé en ce que,
le premier élément de réseau comprend un premier registre des abonnés nominaux (Home Location Register) (HLR_1).

16. Système comprenant au moins un système de gestion (OS), un certain nombre de premiers systèmes gérés (NE_1; HLR_1) et un certain nombre de deuxièmes systèmes gérés (NE_2; HLR_2), chaque système géré (NE_1, NE_2; HLR_1, HLR_2) comprenant un certain nombre d'objets gérés (MO) représentant des ressources, une interface de gestion (Q3) pour permettre une communication entre les systèmes de gestion et les systèmes gérés, par l'intermédiaire de laquelle des opérations de gestion peuvent être envoyées à partir du ou des systèmes de gestion (OS) vers le ou les systèmes gérés (NE_1, NE_2; HLR_1, HLR_2),
caractérisé en ce que,
pour offrir une redondance, des moyens pour mettre en oeuvre une fonction de reproduction sont prévus pour reproduire une opération de gestion, qu'un premier système géré comprend des moyens de traitement, par l'intermédiaire d'un traitement dans ledit premier système géré (NE_1; HLR_1), pour décomposer l'opération de gestion en un certain nombre d'opérations d'instances d'objets gérés (MO), ledit premier système géré comprenant de plus des moyens pour mettre en oeuvre une fonction de reproduction (5) pour reproduire chaque opération d'instance d'objet géré (MO), constituant ainsi la reproduction de l'opération de gestion, et **en ce que** des moyens sont prévus pour envoyer lesdites opérations d'instances d'objets gérés à partir dudit premier système géré vers au moins un deuxième système géré (NE_2; HLR_2).

17. Système selon la revendication 16,
caractérisé en ce que,
des moyens (8a) pour mettre en oeuvre une fonctionnalité de translation sont prévus dans le premier et/ou deuxième système géré, configurés de sorte que pour des opérations d'instances reproduites, une translation est effectuée des paramètres ayant respectivement des valeurs différentes dans les premier et deuxième systèmes gérés.

18. Procédé pour offrir une redondance dans un système comprenant au moins un premier et deuxième systèmes gérés, dont chacun comprend un certain nombre d'objets gérés (MO), le procédé comprenant les étapes consistant à,
lorsqu'une opération de gestion est envoyée vers un premier système géré (NE_1/HLR_1) :

- établir dans le premier système géré (NE_1; HLR_1) lesquelles des instances d'objets gérés sont concernées,
- décomposer l'opération de gestion en un certain nombre d'opérations d'instances, et

pour chaque opération d'instance :

- examiner si des conditions de reproduction sont données, et dans l'affirmative, examiner si celle(s)-ci sont remplies,
- dans l'affirmative, envoyer l'opération d'instance audit au moins un deuxième système géré,
- invoquer l'opération d'instance dans les pre-

mier et deuxième systèmes gérés.

19. Procédé selon la revendication 16,
caractérisé en ce que,
il comprend les étapes supplémentaires consistant à :

- translater les paramètres d'une opération d'instance qui ont respectivement des valeurs différentes dans les premier et deuxième systèmes.

20. Procédé selon la revendication 19,
caractérisé en ce que,
la translation s'effectue dans le premier système géré avant d'envoyer l'opération d'instance vers ledit au moins un deuxième système géré.

21. Procédé selon la revendication 19,
caractérisé en ce que,
il comprend les étapes consistant à :

- envoyer une opération d'instance reproduite vers un deuxième système géré,
- effectuer la translation dans le deuxième système géré,
- invoquer l'opération d'instance.

22. Procédé selon l'une quelconque des revendications 18 à 21,
caractérisé en ce que,
les opérations d'instance d'une opération de gestion sont reproduites et invoquées, une par une.

23. Procédé selon l'une quelconque des revendications 18 à 21,
caractérisé en ce que,
un certain nombre d'opérations d'instances d'une opération de gestion sont au moins en partie gérées en parallèle.

24. Procédé selon l'une quelconque des revendications 18 à 23,
caractérisé en ce que,
si une défaillance d'opération se produit dans l'un quelconque des systèmes gérés, les opérations sont révoquées à la fois dans le premier et le deuxième système géré.

FIG. 1

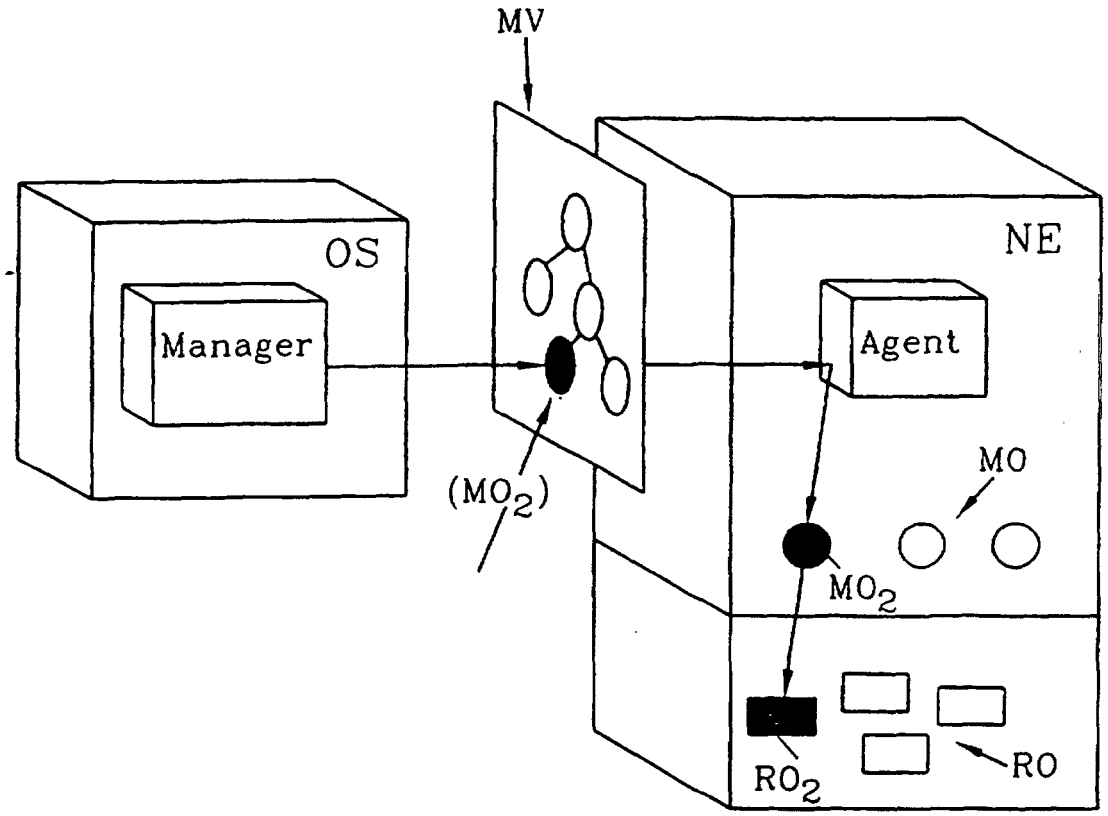


FIG.2

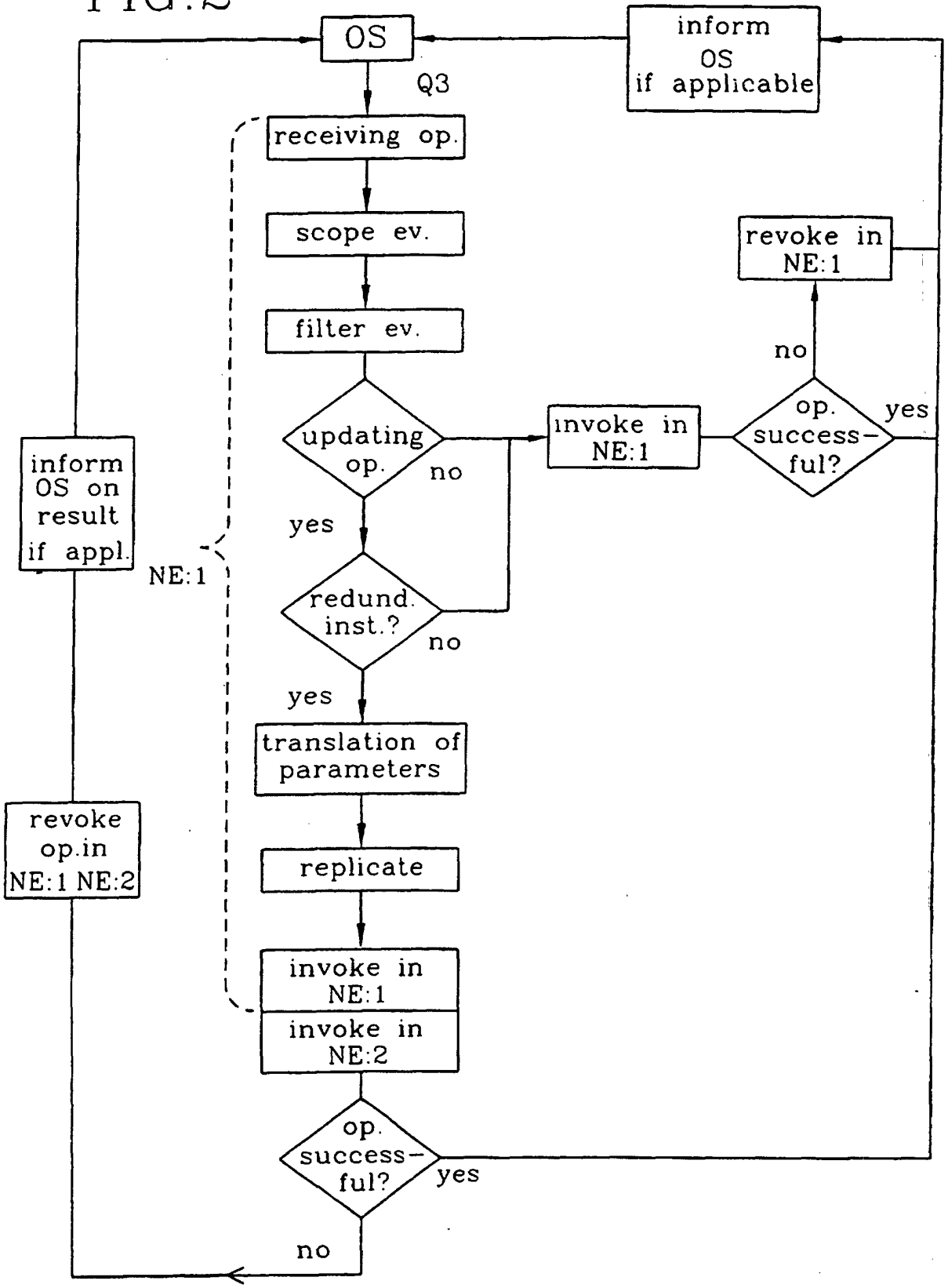
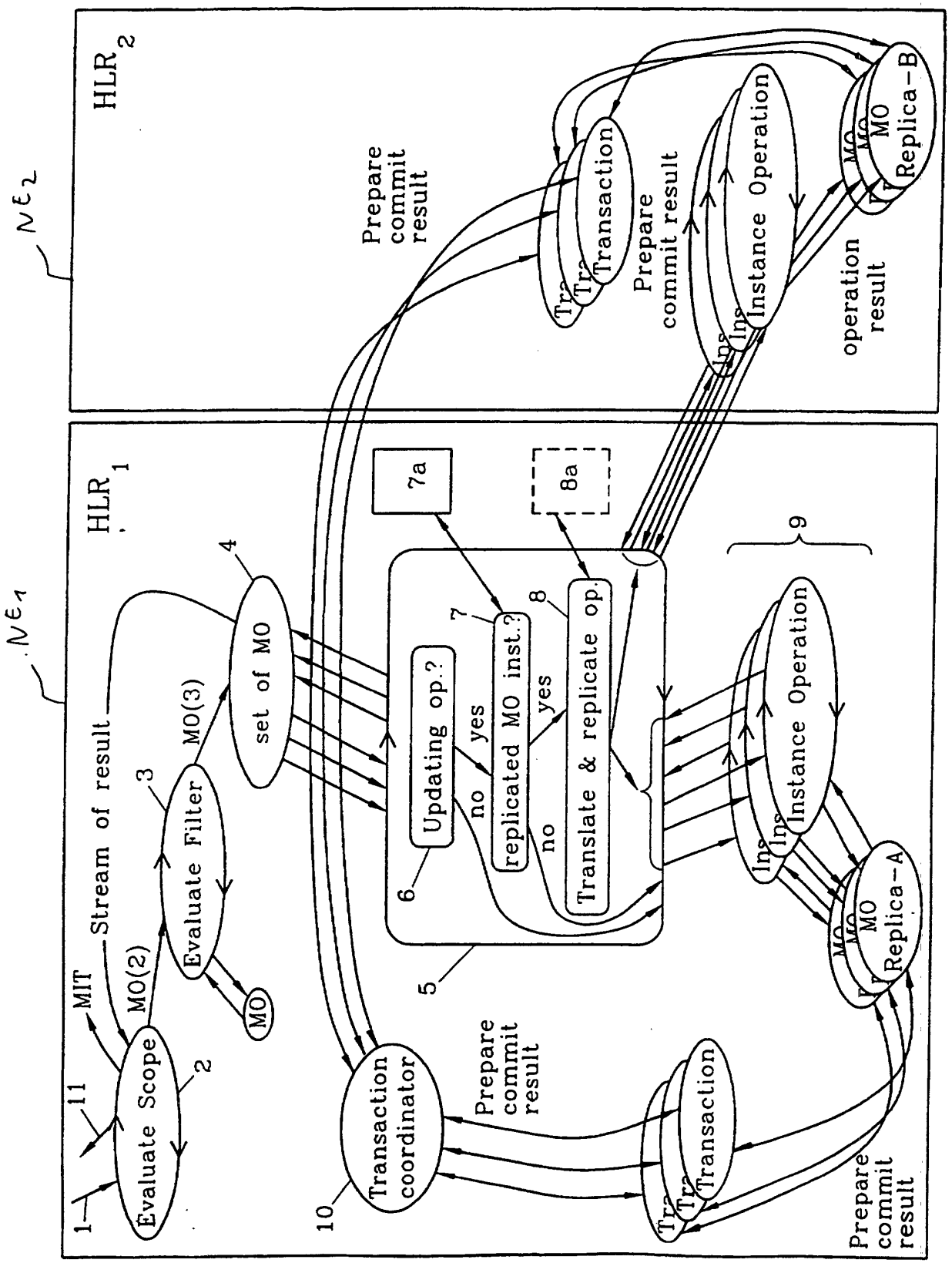

OS
Q3
receiving op.
scope ev.
filter ev.
updating op.
no
yes
redund. inst.?
no
yes
translation of parameters
replicate
invoke in NE:1
invoke in NE:2
op. success-ful?
yes
no
NE:1
inform OS on result if appl.
revoke op.in NE:1 NE:2
invoke in NE:1
op. success-ful?
yes
no
revoke in NE:1
inform OS if applicable

FIG.3


NE2
HLR2
Prepare commit result
Tra
Transaction
Prepare commit result
Ins
Instance Operation
operation result
MO
Replica-B
NE1
HLR1
Stream of result
MIT
MO(2)
MO(3)
Evaluate Scope
Evaluate Filter
set of MO
MO
11
1
2
3
4
7a
8a
9
Updating op.?
replicated MO inst.?
Translate & replicate op.
yes
no
6
7
8
5
Transaction coordinator
10
Prepare commit result
Replica-A